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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/579,226	05/12/2006	Philippe Belleville	10404.042.00	6388

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EXAMINER	
BERDICHEVSKY, MIRIAM	
ART UNIT	PAPER NUMBER
1795	
MAIL DATE	DELIVERY MODE
11/09/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/579,226	BELLEVILLE ET AL.	
	Examiner	Art Unit	
	MIRIAM BERDICHEVSKY	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *rce 9/4/2009* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9 and 11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9 and 11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Remarks

Claims 1-9 and 11 are amended. Claims 1-9 and 11 are currently pending.

Status of Rejections

The rejections based on Yanagida are withdrawn in view of Applicant's submission of a certified copy and English translation of FR 0350841.

All rejections other the previous office action are withdrawn in view of Applicant's amendments.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. Claims 1-2, 5-7, 9 and 11 are rejected35 U.S.C. 103(a) as being unpatentable over Ding (*"Nanofabrication of Organic/Inorganic Hybrids of TiO_2 with Substituted*

Phthalocyanine or Polythiophene") and Zhao (*Polymer brushes: surface immobilized macromolecules*).

As to claim 1, Ding teaches a method of preparing a pn—semiconductor material that can be obtained by the following steps: a step in which a substrate made of porous oxide ceramic (porous TiO_2 nanoparticles – section I, ¶ 2) is functionalized by chemical grafting of one or more compounds containing at least one group (carboxylic groups, sulfonic acid groups- section I, ¶ 3) that can be polymerized with one of more precursors of an electrically conducting polymer (PTAA - section I, ¶ 3) and at least one group able to be chemically grafted (covalent linkage - section I, ¶ 3) onto said substrate; and a step in which the substrate thus functionalized is impregnated with a solution containing an electrically conducting polymer (section 3.1.2., ¶ 1).

Ding is silent to a step in which the substrate thus functionalized being impregnated with a solution containing the precursor(s); and a step in which the precursor(s) are polymerized.

Zhao teaches a conventional chemical grafting method (grafting from) that requires the step of functionalizing the surface (I, initiators) and impregnating with a solution of precursors (M, monomers) which are then polymerized (Figure 9). Zhao teaches that the advantage of using 'grafting from' rather than the method taught by Ding (grafting to) is that there is an increase in grafting density, as taught by Zhao (page 693 and 695, section 4).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the 'grafting from' method of Zhao in Ding because 'grafting from'

decreases the amount of steric hindrance because the precursor (monomers) are smaller molecules than polymers and can readily reach the substrate to link (Zhao: page 695).

Regarding claims 2 and 5, Ding teaches that the ceramic is TiO_2 (section 1, ¶ 2).

Regarding claim 6, Ding teaches that the group able to be chemically grafted onto the ceramic is $COOR^1$ where R^1 represents a hydrogen atom (carboxylic groups) or phthalocyanine tetrasulfonic acid tetrasodium salt SO_3M'(section 1, ¶ 3).

Regarding claim 7, modified Ding teaches that the group chosen $COOR^1$ and SO_3M' can be polymerized with precursors (Zhao: see claim 1) of an electrically conducting polymer chosen group thiophene (PTAA) (Ding: section 1, ¶ 3).

Regarding claim 9, modified Ding teaches that the porous oxide ceramic substrate is TiO_2 chemically grafted by thiophene-3-acetic acid (if the polymer directly bonds to the substrate then the link between the substrate and the polymer less one unit will be a monomer of the polymer which is thiophene-3-acetic acid) to an alkylthiophene (remainder of the PTAA) (Figure 1). Therefore, in the event of using 'graft from' the first linkage between a monomer and the porous oxide will provide the functionalization with the required formula followed by polymerization with the remainder of the monomers, alkylthiophenes to produce grafted PTAA.

As discussed above in relation to claim 1, it would have been obvious to one of ordinary skill in the art to use “graft from” because ‘grafting from’ decreases the amount of steric hindrance because the precursor (monomers) are smaller molecules than polymers and can readily reach the substrate to link (Zhao).

Regarding claim 11, modified Ding teaches the use of the pn-semiconductor material comprising a porous metal oxide ceramic chemically grafted to an electrically conducting polymer grafted thereto for use in a solar cells (section 1, ¶ 1), but is silent to the pn-semiconductor material being between the electrodes.

It would have been obvious to one of ordinary skill in the art to at the time of the invention to place the pn-semiconductor material between a first and second electrode in the solar cell because otherwise the solar cell would not function.

5. Claims 3-4, 8 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ding and Zhao as applied to claim 1 above, and further in view of O'regan (*A low cost, high efficiency solar cell based on dye sensitized colloidal TiO_2 films*).

Applicant is directed to the paragraphs above for a complete discussion of Ding and Zhao.

Regarding claim 3, modified Ding does not specify that the nanoparticles are mesoporous.

O'Regan teaches mesoporous (2-50nm) nanoparticles (page 738, ¶ 3).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the mesoporous nanoparticles of O'Regan in Ding because the optimum diameter value of pores that results from a compromise between increased surface area (more smaller pores) and large enough diameter to decrease steric hindrance effects during polymerization) is a result effective variable that involves only routine skill in the art especially in light of the fact that the porous oxide films of O'Regan display exceptionally high efficiencies (abstract).

Regarding claim 4, Ding teaches that the nanoparticles are mesostructured (network of porous nanoparticles) (section I, ¶ 2).

Regarding claim 8, Ding teaches that sensitization of the semiconductor with dye (chromophores) is well known in the art (section 1) and that the semiconductor of Ding can be sensitized with dye or conducting polymer but is silent to the sensitization of both dye and polymer at the same time.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use both dye and polymer to sensitize the semiconductor because it has been held that combing two elements known useful for the same purpose to form a third used for the same purpose flows logically from their having been individually taught (MPEP 2144) especially in light the fact that the dye molecules give rise to electron injection into the semiconductor, as taught by O'Regan (page 737). Moreover, using both conducting polymer and dye would have produced the predictable result of added semiconductor coverage with electron injection molecules.

Regarding claim 11, modified Ding teaches the use of the pn-semiconductor material comprising a porous metal oxide ceramic chemically grafted to an electrically conducting polymer grafted thereto for use in a solar cells (section 1, ¶ 1), but is silent to the pn-semiconductor material being between the electrodes.

It would have been obvious to one of ordinary skill in the art to at the time of the invention to place the pn-semiconductor material between a first and second electrode in the solar cell because otherwise the solar cell would not function.

Response to Arguments

1. Applicant's arguments with respect to claims 1-9 and 11 have been considered but are not persuasive. Applicant argues that Applicant teaches the use of a precursor which is advantageous over polymers because precursor molecules are smaller and more capable of impregnating the substrate. In addition, Applicant argues that Zhao does not teach impregnation. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The Examiner agrees and has sited Zhao as a teaching of using precursors (monomers) rather than polymers as a method of increasing grafting density because there is less steric hinderance (pages 693 and 695). In regards to impregnation, the Examiner notes that the nanoporous substrate of Ding would be impregnated inherently as a result of being porous.

2. In response to applicant's argument that Zhao is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Ding is drawn to a solar cell wherein polymer is tethered from a substrate. Ding teaches that covalently (tethering) linking polymer to a substrate is more advantageous than the adsorption of the prior art (section 1). Zhao is a summary of the tethered polymer art

such that one of ordinary skill in the art looking to solve the problem of how to tether polymers to a substrate would look to the tethered polymer art such as Zhao. Especially in light the fact that KSR has held that it would have been obvious to chose from finite possibilities with a reasonable expectation of success.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **MIRIAM BERDICHEVSKY** whose telephone number is (571)270-5256. The examiner can normally be reached on M-Th, 10am-8pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer Michener can be reached on (571) 272-1424. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. B./
Examiner, Art Unit 1795

/Jennifer K. Michener/
Supervisory Patent Examiner, Art Unit 1795